ADJUSTABLE BIASING DEVICE FOR SHEET MEDIA FEEDER

BACKGROUND

Sheet media feeders are widely used in a variety of devices such as in printers, copy machines, facsimile machines and the like. In general, sheets of media, such a paper, and the like, are stored in a stack of media, and the sheet media feeder includes engaging structures, such as a roller or the like, for separating one sheet from the stack and urging it along a media path of the device.

In order to ensure consistent and reliable separation of the sheet of media from the stack of media, the sheet of media typically engages the engaging structure within a predefined range of force between the sheet of media and the engaging structure. If too much force is applied, the sheet may not separate from the stack, and if too little force is applied, the sheet may not properly engage the engaging structures.

In many situations, it is undesirable to apply a large biasing force to a large stack of media. For example, where the individual sheets of media form a vertical stack of media, and those sheets of media are relatively massive and/or fragile, such as when they are individual polymer identification cards or the like being fed through an identification card printer, the weight of the large stack of media tends to urge the lowest sheet of media within that stack toward the engaging structure. Accordingly, it may be unnecessary to apply any additional biasing force to the stack of media, and such additional force creates extra load to the engaging structure and ultimately to the driving mechanism causing system stall.

Similarly, as the sheets of media are consumed from the stack of media, the weight of the stack of media is reduced. Accordingly, the remaining

stack of media cannot contribute significantly to the biasing of the bottom most sheet of media toward the engaging structure.

Therefore, the force applied to the stack of media is desirably sufficient to urge the bottom most sheet of media in the stack of media toward the engaging structure when the stack of media is nearly depleted, while still preventing excessive force from being applied when the stack of media is large. In practice, this characteristic tends to limit the size or height of the stack of media allowed within the frame.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a back isometric view of a printer having a sheet media feeder with a stacked media-biasing device therein in accordance with an embodiment of the present invention.

FIG. 2 is an isometric lower view of the sheet media feeder that is installed on a media engaging structure, with a stacked media-biasing device of FIG. 1.

FIG. 3 is a fragmentary top isometric view of the sheet media feeder of FIG. 2 with a portion of the cover removed to show internal detail and a possible full stack of media.

FIG. 4 is the fragmentary top isometric view of the sheet media feeder with a portion of the cover removed of FIG. 3 showing a possible substantially depleted stack of media.

FIG. 5 is an enlarged isometric view of a portion of the biasing structure of the sheet media feeder of FIG. 2.

FIG. 6 is a fragmentary cross-sectional view taken along line 6-6 of FIG. 4.

FIG. 7 is a fragmentary cross-sectional view taken along line 7-7 of FIG. 3.

DETAILED DESCRIPTION OF EXAMPLE EMBODIMENTS

A biasing device 20 for a sheet media feeder 22 that allows the amount of force applied to a stack of media 10 to be optimized as the stack of media 10 is depleted is disclosed in FIGS. 1-7.

1. Exemplar media-path bearing device

Referring to FIG. 1, the sheet media feeder 22 containing the biasing device 20 is operably secured to a media-path bearing device 24, such as a printer 24', copier, facsimile machine or the like. The media-path bearing device 24 shown in FIG. 1 may bean inkjet printer 24' or other suitable printer containing the sheet media feeder 22 detachably secured thereto.

In one implementation, the inkjet printer 24' includes a chassis 30, the sheet media feeder 22 for supplying sheets of media 32 to the printer 24' via a media path 34, and a movable print carriage for moving one or more printheads relative to the sheet of media 32 at a print zone. The sheets of media 32 may be any type of suitable sheet material, such as paper, card-stock, transparencies, mylar, foils, and the like, but for convenience, the illustrated embodiment is described using a substantially planar, polymer card that includes a planar surface 36 (FIGS. 6 & 7) adapted to be printed thereon. Such cards are often used to produce identification badges, driver's licenses, and the like.

The sheet media feeder 22 moves the sheet of media 32 into the print zone from a storage chamber 38 along the media path 34, using a series of motor-driven rollers or the like, here rollers 40a, 40b, which are secured to the printer so as to engage the detachable sheet media feeder, are shown in FIG. 2. A plurality of sheets of media 32 forming a substantially vertical stack of media 10 is stored within the storage chamber 38 thereby defining a stack height 42 (FIG. 7).

In the print zone, the sheets of media 32 receive ink from a printhead, which is operably secured to the carriage (not shown). The carriage is usually driven by a conventional drive belt/pulley and motor arrangement along a

guide rod or the like. The guide rod defines a scanning direction or scanning axis along which the printheads traverse over the print zone. The printheads selectively deposit one or more ink droplets on the planar surface of the sheet of media located in the print zone in accordance with instructions from a printer controller, such as a microprocessor, which may be located within chassis 30.

The controller may receive an instruction signal from the microprocessor based on sensors along the media path 34, and from a host device (not shown). The printhead carriage motor and the media delivery system drive motor operate in response to the printer controller, which may operate in a manner well known to those skilled in the art.

In other embodiments, a laser print engine or other suitable print engine may be used instead of an inkjet print engine.

2. Sheet Media Feeder

As shown in FIGS. 2-4, the sheet media feeder 22 may include a frame 44 defining the storage chamber 38 therein for receiving the stack of media 10 so as to allow an outer most sheet of media 32 within the stack of media 10 to engage the media engaging structure 12, such as a roller 40c or the like. Accordingly, the media engaging structure12 thereby engages and separates, one-by-one, individual sheets of media 32 from the stack of media 10, and urges each sheet from the stack of media 10 along the media path 34.

The frame 44 can have at least one side 46 and the stack of media 10 rests within the storage chamber 38 adjacent to the at least one side 46. In one implementation, the frame 44 has a lower side 46' and an upper side 48 and the stack of media10 is stacked substantially vertically on the lower side 46' with the media engaging structure12 positioned adjacent to the lower side 46' as shown in FIG. 2. The media engaging structure 12 extends through an opening 50 in the lower side 46' of the frame 44 to operably engage the lowest most sheet of media 32a within the stack of media 10 and urge the lowest most sheet of media 32a through a slot 52 in the frame toward additional downstream rollers 40a, 40b or the like along the media path 34.

The frame 44 can include a base structure 44a with a transparent cover 44b detachably secured thereto thereby allowing the stack of media 10 to be viewed through the cover 44b.

The biasing device 20 operably engages the stack of media 10 to bias the stack of media 10 towards the media engaging structure 12. In the illustrated example embodiment, the biasing device 20 applies a force substantially normal to a planar surface 54 on the stack of media 10, and the amount of force applied by the biasing device 20 to the stack of media 10 is adjustable so that the amount of force applied may be optimized as the stack of media 10 is depleted from the storage chamber 38.

For example and as shown in FIGS. 3-7, a compression spring 56 can extend between the frame 44 and the stack of media 10, with a threaded adjustment control 60 operably secured to a first end 62 of the compression spring 56 as shown. The threaded adjustment control 60 is operably received within a mating threaded opening 64 on the frame 44 so as to allow the adjustment control 60 to move toward the stack of media 10 by turning the adjustment control 60 within the threaded opening 64. Accordingly, by turning the treaded adjustment control 60 in a first direction 68 (FIG. 3), the adjustment control 60 moves closer to the stack of media 10, thereby driving out more pitches of the spring 56 against the stack of media 10 and increasing the amount of force applied to the stack of media 10.

In order to prevent the second end 70 of the compression spring 56 from adversely impacting the upper most sheet of media 32b of the stack of media 10, a spring engaging structure 72 can be positioned between the stack of media 10 and the second end 70 of the compression spring 56. In one possible implementation, the spring engaging structure 72 has a substantially planar member 74 that engages the upper most sheet of media 32b of the stack of media 10 on a first side 76, and has a protrusion 78 extending from its opposite second side 80 toward the threaded opening 64. A disk 82 that is sized to engage the second end 70 of the compression spring 56 is rotatably secured to the protrusion 78. Accordingly, when the

adjustment control 60 is rotated within the threaded opening 64, the compression spring 56 will necessarily rotate and cause the second end 70 to spin the disk 82 about the protrusion78 and thereby prevent the second end 70 from digging into the stack of media10 or otherwise hindering rotation of the compression spring 56 and adjustment control 60. The disk 82 can also include a strain gauge 84 or the like thereon which is visible through the frame 44 thereby allowing the amount of force applied by the compression spring 56 to the stack of media10 to be monitored and tuned accordingly.

The treaded adjustment control 60 can include a knob portion 90 that allows a user to easily grasp and rotate the adjustment control 60. In one possible implementation, the knob portion 90 includes a position indicator 92 such as an elongate needle portion or the like to provide a user with a visual indication of the position of the knob portion 90 relative to the frame 44.

The threaded opening 64 can be a threaded and tapered collar 64a received within the upper side 48 of the frame 44. The collar 64a can have a threaded length 94 that provides the adjustment control 60 sufficient range of movement therein so as to allow the compression spring 56 to provide an optimal force between the stack of media10 and the engaging structure12, even when the stack of media10 is substantially depleted or even if only one sheet of media 32 is remaining from the stack of media 10.

As shown in FIGS. 6 & 7, the compression spring 56 can also be retractable within the threads of the threaded opening 64, thereby defining a retracted position 100 as shown in FIG. 7 and an extended position 102 as shown in FIG. 6. In one possible implementation, the pitch 104 of the threaded opening 64 is less than the pitch 106 (FIG. 5) of an unloaded portion of the compression spring 56. Accordingly, the retained portion 108 of the compression spring 56 received within the threaded opening 64 is compressed to optimize space, while not allowing the retained portion 108 of the compression spring 56 to contribute to the force applied to that stack of media 10. Since, only the extended portion 110 of the compression spring 56, that is the portion that extends between the threaded opening 64 and the

stack of media 10 applies a force to the stack of media 10, the amount of force applied to a full stack of media 10' (FIG. 7) can be minimized, while still allowing the force applied to a substantially depleted stack of media 10" (FIG. 6) to be increased as needed for proper engagement between the sheet of media 32a and the engaging structure 12.

The difference in pitch 104 (FIG. 6), 106 (FIG. 5) between the threaded opening 64 and the uncompressed spring 56 also serves to limit the direction of rotation of the adjustment control 60. The adjustment control 60 can be easily rotated in the first direction 68 within the threaded opening 64 so as to uncoil the spring 56 from the threaded opening 64 and thereby increase the amount of force applied by the compression spring 56. However, an extended compression spring 56 will not as easily be compressed back into the threaded opening 64 by turning the adjustment control 60 in the opposite second direction, thereby limiting a user's ability to inadvertently reduce the amount of force applied by the spring 56 as the stack of media 10 is depleted.

The adjustability of the biasing device 20 allows a full stack of media 10' (FIGS. 3 & 7) to be stored within the storage chamber 38 without compromising the biasing force applied to a substantially depleted stack of media 10" (FIGS. 4 & 6) and without applying too much force when the stack of media 10 is substantially full. Accordingly, an operator need not replenish or replace the stack of media 10 as frequently for engaging reliability reasons.

Moreover, the rectractability of the spring 56 within the threaded opening 64 also allows the biasing force applied to the stack of media 10 to be minimized when not needed, such as during storage and/or shipment of the media feeder 22 containing the stack of media 10. Common biasing structures usually store and ship the media feeder containing the stack of media with the compression spring fully compressed against the stack of media, thereby applying the maximum biasing force to the stack of media for extended periods of time. Accordingly, such forces can tend to damage the sheets of media within the stack, particularly, where the media are sheets of resilient, polymer cards used for identification badges and the like.

3. Use and Operation

A user activates the adjustable biasing device 20 by turning the adjustment control 60 as needed to apply the necessary force to the stack of media 10. The position indicator 92 and, if installed, the transparent cover 44b and strain gauge 84 allow the user to see if the second end 70 of the spring is operably engaging the stack of media 10 and adjust the biasing force applied as needed. Moreover if desired, the frame 44 includes surface ornamentation thereon relative to defined aligned positions of the position indicator 92 thereby allowing a user to position the knob portion 90 of the adjustment control 60 for a known stack size or the like.

In an example embodiment, the sheet media feeder 22 is a pre-packaged cartridge-style structure that contains a full stack of media therein. The structure can arrive with the biasing device 20 in its retracted position 100 so as to prevent excessive force from being applied to the stack of media10 during initial transport and storage of the structure. A user obtains a new sheet media feeder 22 and turns the adjustment control 60 to a defined position so as to extend the spring 56 from the threaded opening 64 and apply a biasing force to the stack of media10. The user then installs the sheet media feeder 22 on the media-path bearing device 24, such as a printer 24' or the like.

As the printer 24’ is used and the sheets of media 32 are depleted one-by-one, from the stack of media 10, the user turns the adjustment control 60, so as to maintain a desirable biasing force on the stack of media 10. If available, the user can align the position indicator 92 on the adjustment control 60 to defined positions for the detected stack height 42 of the stack of media 10. This process of adjusting the adjustment control 60 is repeated as needed during depletion of sheets of media 32 from the stack of media 10 thereby maintaining optimal biasing force on the stack of media 10 as it is being depleted.

Alternatively, in cases where the strain gauge 84 is installed, the user can position the adjustment control 60 so as to maintain the force applied to

the strain gauge 84 within a predetermined range. As the detected force drops below a predefined limit, the user readjusts the position control 60 accordingly so as to return the force applied to the strain gauge 84 to within the predetermined range.

Also, in cases where a transparent cover 44b is installed, the user can view through the transparent cover 44b the engagement between the second end 70 of the biasing device 20 and the substantially planar member 74. Should the second end 70 ever become disengaged from the substantially planar member, the user can position the adjustment control 60 so as to move the second end 70 toward the substantially planar member 74, thereby increasing the biasing force applied to the stack of media.

In view of the wide variety of embodiments to which the principles of the invention can be applied, it should be apparent that the detailed descriptions of exemplar embodiments are illustrative only and should not be taken as limiting the scope of the invention. For example, exemplar type of media-path bearing device is for illustrative purposes only. Accordingly, the claimed invention includes all such modifications as may come within the scope of the following claims and equivalents thereto.